CLAIMS

1. A multi-stage centrifugal compressor mechanism comprising a housing, a drive shaft rotatably mounted within the housing, a plurality of fixed members disposed within the housing and defining a plurality of interconnected fluid chambers, a plurality of impellers mounted on the drive shaft and disposed relative to the fixed members such that each impeller delivers compressed fluid to a respective fluid chamber, a bypass channel extending between two of the fluid chambers to enable fluid to pass between those chambers without compression, and means for controlling the flow of fluid through the bypass channel.

2. A mechanism according to Claim 1, wherein the control means is arranged to open the bypass channel under the influence of a pressure difference between said two of the fluid chambers.

3. A mechanism according to Claim 1or Claim 2, wherein the control means is arranged to open the bypass channel when the pressure in an upstream one of said two of the fluid chambers is greater than the pressure in a downstream one of said two of the fluid chambers.

4. A mechanism according to any preceding claim, wherein said two of the fluid chambers are adjacent fluid chambers of the compressor mechanism.

5. A mechanism according to Claim 4, wherein the bypass channel passes through the fixed member located between the adjacent fluid chambers.

6. A mechanism according to any preceding claim, wherein the control means comprises valve means.

7. A mechanism according to Claim 6, wherein the valve means comprises a valve member displaceable in use between a closed position and an open position by pressurised fluid.

8. A mechanism according to Claim 7, wherein the valve member comprises a flap valve.

9. A mechanism according to any of Claims 6 to 8, wherein the valve means is located within a fluid chamber.

10. A mechanism according to any preceding claim, comprising, for each fluid chamber, a respective bypass channel extending between that fluid chamber and the adjacent downstream fluid chamber, and means for controlling the flow of fluid through each bypass channel.

11. A mechanism according to any preceding claim, further comprising surge control means for controlling surge within the multi-stage centrifugal compressor mechanism.

12. A multi-stage centrifugal compressor mechanism comprising a housing, a drive shaft rotatably mounted within the housing, a plurality of fixed members disposed within the housing and defining a plurality of interconnected fluid chambers, a plurality of impellers mounted on the drive shaft and disposed relative to the fixed members such that each impeller delivers compressed fluid to a respective fluid chamber, and surge control means for controlling surge within the multi-stage centrifugal compressor mechanism.

13. A mechanism according to Claim 11 or Claim 12, wherein the surge control means comprises means for conveying a stream of fluid to each fluid chamber, and means for controlling the rate of flow of the fluid stream into each fluid chamber.

14. A mechanism according to Claim 13, wherein the conveying means is arranged to convey a stream of purge gas to each fluid chamber.

15. A mechanism according to Claim 14, wherein the purge gas comprises air or an inert gas.

16. A mechanism according to Claim 13, wherein the conveying means is arranged to convey a stream of compressed fluid to each fluid chamber from a downstream fluid chamber.

17. A mechanism according to Claim 16, wherein the conveying means comprises, for each fluid chamber, a fluid passage extending between that fluid chamber and the adjacent downstream fluid chamber.

18. A mechanism according to Claim 17, wherein the fluid passages are co-axial.

19. A mechanism according to Claim 17 or Claim 18, wherein each fluid passage passes through a respective fixed member.

20. A mechanism according to any of Claims 16 to 19, wherein the control means comprises valve means in fluid communication with said conveying means.

21. A mechanism according to Claim 20, wherein the valve means comprises a spool valve.

22. A mechanism according to any preceding claim, wherein each fixed member comprises a disc mounted on, or integral with, a respective part of the housing.

23. A mechanism according to any preceding claim, comprising means for cooling the fixed members.

24. A mechanism according to Claim 23, wherein the cooling means comprises a plurality of cooling fins located on one side of each fixed member.

25. A mechanism according to Claim 23 or Claim 24, wherein the cooling means comprises means for supplying a flow of coolant to each fixed member.

26. A mechanism according to any preceding claim, comprising a cooling jacket extending about at least part of the multi-stage centrifugal compressor mechanism.

27. A vacuum pump comprising a multi-stage centrifugal compressor mechanism according to any preceding claim.

28. A vacuum pump according to Claim 27, comprising, upstream from the compressor mechanism, a molecular drag mechanism.

29. A vacuum pump according to Claim 28, wherein the molecular drag mechanism comprises a Holweck mechanism.

30. A vacuum pump according to Claim 28 or Claim 29, wherein the molecular drag mechanism comprises at least one rotor element mounted on the drive shaft.

31. A vacuum pump according to Claim 30, wherein the molecular drag mechanism at least partially surrounds a motor for rotating the drive shaft.

32. A vacuum pump comprising a multi-stage centrifugal compressor mechanism comprising a plurality of rotor elements mounted on a rotatably mounted drive shaft, and, upstream therefrom, a molecular drag mechanism comprising at least one rotor element mounted on the drive shaft, wherein the at least one rotor element of the molecular drag mechanism at least partially surrounds a motor for rotating the drive shaft.

33. A vacuum pump according to any of Claims 30 to 32, wherein said at least one rotor element of the molecular drag pumping mechanism comprises a cylinder mounted for rotary movement with the rotor elements of the compressor mechanism.

34. A vacuum pump according to any of Claims 27 to 33, comprising means for monitoring the temperature of the pump, and means for controlling the speed of rotation of the shaft in dependence on the monitored temperature.

35. A vacuum pump according to any of Claims 27 to 34, wherein the multi-stage centrifugal compressor mechanism is arranged to exhaust compressed fluid at or around atmospheric pressure.

36. A vacuum pump comprising a multi-stage centrifugal compressor mechanism for receiving fluid to be pumped and exhausting compressed fluid substantially at atmospheric pressure.

37. A vacuum pumping arrangement comprising a booster pump in series with a backing pump, wherein the booster pump comprises a vacuum pump according to any of Claims 27 to 34.

38. A vacuum pumping arrangement comprising a booster pump in series with a backing pump, wherein the backing pump comprises a vacuum pump according to any of Claims 35 and 36.

39. A vacuum pumping arrangement comprising a booster pump in series combination with a backing pump, wherein the booster pump comprises a molecular drag mechanism and a multi-stage centrifugal compressor mechanism for exhausting fluid at a sub-atmospheric pressure, and the backing pump comprises a multi-stage centrifugal compressor mechanism for exhausting fluid at or around atmospheric pressure.

40. A vacuum pumping arrangement according to any of Claims 37 to 39, comprising a bypass conduit connected between an exhaust from the booster pump and an exhaust from the backing pump, and means for controlling the flow of fluid through the bypass conduit.